National Advisory Committee for Aeronautics

Research Abstracts

NO. 71 OCTOBER 7, 1954

CURRENT NACA REPORTS

NACA RM E54G07

INVESTIGATION OF NOISE FIELD AND VELOCITY PROFILES OF AN AFTERBURNING ENGINE. Warren J. North, Edmund E. Callaghan and Chester D. Lanzo. September 1954. 23p. diagrs., photos. (NACA RM E54G07)

Sound pressure levels and jet velocity profiles are presented for an engine-afterburner combination over a range of afterburner fuel-air ratios. At high fuel-air ratios, a severe low-frequency resonance producing high noise levels was encountered. A current fighter aircraft with a different afterburner configuration yielded considerably lower sound pressure levels and resonance-free operation, indicating the importance of acoustic considerations in afterburning designs.

NACA RM E54G22a

RECOVERY CORRECTIONS FOR BUTT-WELDED, STRAIGHT-WIRE THERMOCOUPLES IN HIGH-VELOCITY, HIGH-TEMPERATURE GAS STREAMS. Frederick S. Simmons. September 1954. 19p. diagrs. (NACA RM E54G22a)

Experimental measurements show that a reasonable correlation among recovery corrections at various pressures and temperatures for butt-welded straight-wire thermocouples is given by an empirical equation in which the correction is seen to be proportional to the fifth root of the pressure and inversely proportional to the fourth root of the temperature. Resultant probable errors in temperature measurements are presented and discussed.

NACA TN 3151

EXACT SOLUTIONS OF LAMINAR-BOUNDARY-LAYER EQUATIONS WITH CONSTANT PROPERTY VALUES FOR POROUS WALL WITH VARIABLE TEMPERATURE. Patrick L. Donoughe and John N. B. Livingood. September 1954. 42p. diagrs., 2 tabs. (NACA TN 3151)

Solutions were computed for a Prandtl number of 0.7 and a range of cooling-air flows, and pressure and wall temperature gradients. For each case, boundary layer thicknesses and heat-transfer and friction coefficients were also computed and tabulated. Steeper temperature profiles for a given coolant flow were obtained by increased wall temperature gradients. Wall temperature gradients for zero boundary-layer tamperature gradients at the wall were increased by increased pressure gradient and decreased by increased coolant flow.

NACA TN 3200 *

STRESS ANALYSIS OF CIRCULAR SEMIMONOCOQUE CYLINDERS WITH CUTOUTS BY A PERTURBATION LOAD TECHNIQUE. Harvey G. McComb, Jr. September 1954. 37p. diagrs., 3 tabs. (NACA TN 3200)

A method is presented for analyzing the stresses about a cutout in a circular cylinder of semimonocoque construction. The method involves the use of so-called perturbation solutions which are superposed on the stress distribution that would exist in the structure with no cutout in such a way as to give the effects of a cutout. The method can be used for any loading case for which the structure without the cutout can be analyzed and is sufficiently versatile to account for stringer and shear reinforcement about the cutout.

NACA TN 3213

TRANSONIC FLOW PAST CONE CYLINDERS. George E. Solomon, California Institute of Technology. September 1954. 56p. diagrs., photos. (NACA TN 3213)

Experimental results are presented for transonic flow past cone-cylinder, axially symmetric bodies. The drag coefficient and surface Mach number are studied as the free-stream Mach number is varied and, wherever possible, the experimental results are compared with theoretical predictions. Interferometric results for several typical flow configurations are shown and an example of shock-free supersonic-to-subsonic compression is experimentally demonstrated. The theoretical problem of transonic flow past finite cones is discussed briefly and an approximate solution of the axially symmetric transonic equations, valid for a semi-infinite cone, is presented.

NACA TN 3227

APPLICATION OF TWO-DIMENSIONAL VORTEX THEORY TO THE PREDICTION OF FLOW FIELDS BEHIND WINGS OF WING-BODY COMBINATIONS AT SUBSONIC AND SUPERSONIC SPEEDS. Arthur Wm. Rogers. September 1954. (ii), 91p. diagrs., photo., 3 tabs. (NACA TN 3227)

A theoretical method is evaluated for predicting flow fields behind wings of wing-body combinations at supersonic speeds and slender configurations at subsonic speeds. The method was applied to the calculation of downwash at tail locations behind wings of triangular-wing and cylindrical-body combinations at M = 2.0, to illustrate effects of aspect ratio, angle of attack and incidence, ratio of body radius to wing semispan, and angle of bank on the vortex wake.

*AVAILABLE ON LOAN ONLY.

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NACA TN 3243

THEORETICAL ANALYSIS OF AN AIRPLANE ACCELERATION RESTRICTOR CONTROLLED BY NORMAL ACCELERATION, PITCHING ACCELERATION, AND PITCHING VELOCITY. Christopher C. Kraft, Jr. September 1954. 42p. diagrs., 3 tabs. (NACA TN 3243)

An acceleration restrictor which limits the elevator motion has been analyzed. The system has been assumed to be sensitive to two different control signals. One signal is proportional to normal and pitching acceleration and the other is a function of normal and pitching acceleration and pitching velocity. Several values of time lag in the device used to stop the elevator motion have been studied for two center-of-gravity positions and for forward speeds up to 1,000 feet per second.

NACA TN 3246

AN EXPERIMENTAL INVESTIGATION OF WHEEL SPIN-UP DRAG LOADS. Benjamin Milwitzky, Dean C. Lindquist and Dexter M. Potter. September 1954. 18p. diagrs. (NACA TN 3246. Formerly RM L53E06b)

This paper presents some recently obtained information on landing-gear applied drag loads and on the nature of the wheel spin-up phenomenon in landing, based on a program of tests under controlled conditions in the Langley impact basin. In particular, a study has been made of the nature and variation of the coefficient of friction between the tire and the runway during the spin-up process. Also, comparisons have been made of the various results obtained in forward-speed impacts, forward-speed impacts with reverse wheel rotation, spin-up drop tests, and forward-speed impacts with wheel prerotation.

NACA TN 3262

STARTING AND OPERATING LIMITS OF TWO SUPERSONIC WIND TUNNELS UTILIZING AUXILIARY AIR INJECTION DOWNSTREAM OF THE TEST SECTION. Henry R. Hunczak and Morris D. Rousso. September 1954. 28p. diagrs., photo. (NACA TN 3262)

Data are presented for tunnels operating at Mach numbers 3.85, 3.05, and 2.87 over a range of injector-to-tunnel mass-flow ratios of 0.5 to 1.35. At Mach number 3.85, the starting pressure ratio of 9.8 without injectors but with a fixed second throat was reduced to 4.68 with injectors operating at an injector-to-tunnel mass-flow ratio of 1.27. The running pressure ratio was lowered from 8.3 to 4.5. Corresponding reductions at Mach number 3.05 were from 4.5 to 2.71 for starting and from 4.5 to 2.37 for running at a mass-flow ratio of 0.9.

NACA TN 3285

SECTION CHARACTERISTICS OF AN NACA 0006 AIRFOIL WITH AREA SUCTION NEAR THE LEADING EDGE. James A. Weiberg and Robert E. Dannenberg. September 1954. 47p. diagrs., photos., 3 tabs. (NACA TN 3285)

Results are presented of an investigation of a two-dimensional NACA 0006 airfoil with area suction near the leading edge. The maximum lift of the wing without suction was increased 43 percent for a section flow coefficient of 0.0010 at a free-stream velocity of 162 feet per second.

NACA TN 3287

HEAT TRANSFER FROM A HEMISPHERE-CYLINDER EQUIPPED WITH FLOW-SEPARATION SPIKES. Jackson R. Stalder and Helmer V. Nielsen. September 1954. 29p. diagrs., photos. (NACA TN 3287)

Average heat-transfer, temperature-recovery, and pressure-distribution measurements were obtained over the hemispherical nose of a body of revolution both with and without flow-separation spikes. The tests, conducted in a range of Reynolds numbers from 1.55 to 9.85 x 10^5 and from Mach number 0.12 to 5.04, indicated that in supersonic flow the addition of spikes approximately doubles the rate of heat transfer, regardless of spike length.

NACA TN 3300

INVESTIGATION OF LIFT, DRAG, AND PITCHING MOMENT OF A 60° DELTA-WING—BODY COMBINATION (AGARD CALIBRATION MODEL B) IN THE LANGLEY 9-INCH SUPERSONIC TUNNEL. August F. Bromm, Jr. September 1954. 18p. diagrs., photos. (NACA TN 3300)

Results are presented from tests of the AGARD Calibration Model B in the Langley 9-inch supersonic tunnel. Measurements were made of the lift, drag, and pitching moment at Mach numbers of 1.62, 1.94, and 2.41 and at a Reynolds number, based on body length, of approximately 3.0 x 10^6. The zero-lift drag data compared favorably with available data and were in the proper sequence for the effects of Reynolds number.

BRITISH REPORTS

N-32662*

Nat. Gas Turbine Establishment (Gt. Brit.)
THE REFLECTION AND TRANSMISSION OF PRESSURE DISTURBANCES AT AREA CHANGES IN INFINITE DUCTS. M. V. Nesbitt. February 1954. 103p. diagrs., tab. (NGTE Memo. M. 198)

In most problems involving the propagation of pressure disturbances, reflection, and transmission of the disturbance at area changes must be considered. In this paper data are presented describing the reflection and transmission of pressure disturbances at abrupt area changes inside infinite ducts and at the ends of semi-infinite ducts. The presentation is such that only an initial flow condition, the ratio of the downstream area to the upstream area, the pulse size and its direction of travel need be defined to obtain the magnitude of the reflected and transmitted pulses. Although the results are expressed in terms of the sonic velocities in the various flow regions, they may be readily converted to terms of pressure or velocity. The data refers only to Mach numbers less than 1.

N-32686*

Royal Aircraft Establishment (Gt. Brit.)
A HOT-WIRE ANEMOMETER FOR THE MEASUREMENT OF SMALL AIRFLOWS. P. A. Stickles and T. R. H. Sizer. March 1954. 16p. diagrs., photos. (RAE Tech. Note EL. 50)

The principle underlying the operation of the hot-wire anemometer and its field of application in the measurement of small air flow are described. Full electrical and constructional details of the instrument are given together with details of a cone-valve for controlling the back-pressure and a low-pressure chamber for simulating high altitude conditions. The sources of error are discussed and an indication is given of the limits of accuracy to be expected.

N-32694*

Royal Aircraft Establishment (Gt. Brit.)
APPROXIMATE THEORETICAL CALCULATIONS OF THE EFFECT OF CYLINDRICAL TAILPIPES ON THE THRUST OF A ROCKET MOTOR. D. M. Clemmow. March 1954. 57p. diagrs., 16 tabs. (RAE RPD 18)

Assuming one-dimensional flow (free from oblique shocks) calculations have been made of the effect of nonconducting cylindrical tailpipes on the thrust delivered by rocket motors. Both supersonic and subsonic pipes of a range of lengths and diameters have been examined for a number of different chamber pressures, and for each case optimum area expansion ratios for motors with pipes have been determined. With supersonic pipes the thrust loss increases to a maximum value (of nearly 20 percent for the worst case investigated) which occurs when the pipe is long enough for the flow to become sonic at its downstream end. With subsonic pipes the existence of irreversible flow upstream of the nozzle throat necessitates separate examination of different cases.

N-32695*

Royal Aircraft Establishment (Gt. Brit.)
STATIC AND DYNAMIC RESPONSE OF A DESIGN OF DIFFERENTIAL PRESSURE YAWMETER AT SUPERSONIC SPEEDS. L. J. Beecham and S. J. Collins. February 1954. 56p. diagrs., photos. (RAE GW 19)

Static calibration curves are provided for incidences up to 30° at speeds from M = 1.3 to 1.9, and the instrument is shown to resolve accurately when rolled out of the free stream incidence plane. Relations are developed from which a close approximation to the Mach number, incidence and roll angle may be obtained, without recourse to calibration curves, in terms of the differential pressures across each pair of holes and the pitot pressure measured at an axial hole; the free stream static pressure requires to be determined independently. Dynamic behavior of the instrument and associated pressure pick-ups is examined, and a design developed for which the acoustic natural frequency is high compared with that likely to be encountered in flight.

N-32697*

Nat. Gas Turbine Establishment (Gt. Brit.)
THE DESIGN AND TESTING OF A FULL SCALE VORTEX COMBUSTION CHAMBER FOR RESIDUAL OIL BURNING. A. P. Johnstone. March 1954. 65p. diagrs., photos., 5 tabs. (NGTE Memo. M. 203)

This memorandum describes the design, development, and performance of a large vortex chamber burning 6,000 seconds residual fuel oil. The chamber was designed to pass 38 lb/sec of air at 4 atmospheres and 100 percent overload tests were attempted. The chamber was fully cooled by dilution air for a total loss of 2.0 lb/sq in. at 4 atmospheres. The system had three tangential entries and operated on one, two, or three entries with uniform symmetrical exhaust temperature profiles. Combustion efficiencies were high, 97 to 99 percent, falling off more rapidly below about 50 percent of the design mixture strength.

N-32701*

Ministry of Supply (Gt. Brit.)
AN ANALYSIS OF N. A. C. A. HELICOPTER REPORTS. R. N. Liptrot. May 1954. 61p. diagrs., 5 tabs. (MOS S & TM 7/54)

Theory is compared with flight and model tests, in order to obtain empiric correcting factors which will enable reliable performance estimates to be made for new helicopter designs. A survey of general theory is followed by an analysis of certain American reports. Correcting factors for effective blade drag for tip speed ratio, compressibility and stalling of the retreating blade are derived. A method of calculating the retreating blade tip angle of attack for twisted blades is presented. The work was carried out by the author under Ministry of Supply sponsorship.

N-32723*

Royal Aircraft Establishment (Gt. Brit.)
THE TENSILE PROPERTIES OF D. T. D. 546 AND D. T. D. 687 AFTER HEATING AT ELEVATED TEMPERATURES. May 1954. 5p. diagrs. (RAE Tech. Note Met. 197)

The tensile properties of D. T. D. 546 and D. T. D. 687 after heating at various temperatures up to about 300° C for periods ranging from 5 seconds to 1000 hours have been reviewed and plotted in convenient curves. At temperatures of about 125° C and above, the aluminum-zinc-magnesium alloy D. T. D. 687 loses strength to a very much greater extent than the D. T. D. 546, thus losing the higher strength advantage it possesses at room temperature.

N-32725*

Royal Aircraft Establishment (Gt. Brit.)
TENSILE AND COMPRESSIVE TESTS ON TITANIUM STRIP AT ELEVATED TEMPERATURES. D. C. Hayward. March 1954. 34p. diagrs., photos., 12 tabs. (RAE Tech. Note Met. 194)

The compressive testing of hot rolled commercial purity titanium strip was carried out in a fixture using steel balls to prevent lateral buckling of the test piece. Tests in tension and compression at temperatures ranging from room temperature to 400° C were made to provide data for tangent moduli graphs. Longitudinal and transverse tensile strength values were almost equal but under compression there was marked anisotropy. Strength was well maintained at the higher temperatures. Differences in stiffness were greatest at room temperature but were appreciably reduced at 400° C.

N-32726*

Royal Aircraft Establishment (Gt. Brit.)
DESIGN AND DEVELOPMENT OF THE R. A. E. DUMMY OF THE STANDARD AIRMAN. G. Lovell. May 1954. 27p. diagrs., photos., 4 tabs. (RAE Tech. Note Mech. Eng. 176)

A dummy of the standard airman has been developed at the R. A. E. for use in dynamic and static tests. It has been designed to the dimensions of the average airman and the limbs and the complete man have approximately the correct weights and centers of gravity. Its all up weight is normally 166 pounds but it can be varied from this figure if desired. The dummy has a basic metal structure, covered with foam rubber and articulated at the joints. While it is normally fitted with a simple canvas suit, it can be dressed in standard aircrew clothing, equipment, and headgear. There are cavities for instruments in the head and in the upper and lower trunks. A box containing three mechanical accelerometers mutually at right angles can be fitted in each of these cavities.

N-32727*

Royal Aircraft Establishment (Gt. Brit.)
THE STABILITY OF THE RUNGE-KUTTA METHOD OF SOLUTION OF LINEAR DIFFERENTIAL EQUATIONS. R. H. Merson. June 1954. 12p. diagrs. (RAE Tech. Note GW 320)

The solution of a linear differential equation with constant coefficients as given by the Runge-Kutta method is obtained and the stability is studied. It is shown that the Runge-Kutta solution will be stable when the true solution is stable if the interval of integration is less than about 2.8 times the time constant of every subsidence and less than about 2.8 times the reciprocal of the undamped frequency of every oscillatory mode.

N-32729*

Royal Aircraft Establishment (Gt. Brit.)
CALCULATION OF CHORD AND SPANWISE LOADINGS ON THREE THIN WINGS. L. Klanfer. April 1954. 13p. diagrs., 4 tabs. (RAE Tech. Note Aero 2306)

The pressure distribution over three thin wings has been calculated and compared with results obtained by Redshaw using his "three-dimensional potential analyzer". The agreement is good.

N-32730*

Royal Aircraft Establishment (Gt. Brit.)
FLEXIBLE EDGE ATTACHMENTS FOR WINDSCREENS. F. M. Clowes and L. W. Lord. May 1954. 13p. diagrs., 3 tabs. (RAE Tech. Note Chem. 1228)

A flexible edge attachment consisting of glass cloth and polyvinylbutyral has been developed for aircraft windscreens. While the attachment enables the windscreen to be bolted securely to the frame, it will accommodate a difference of thermal expansion between the frame and the windscreen. The joint strength decreases with rise in temperature so that the method is best suited to normal and low temperature conditions.

MISCELLANEOUS

N-3074D

INDEX OF NACA TECHNICAL PUBLICATIONS, JUNE, 1953 - MAY, 1954. 1954. viii, 212p. (NACA)

There is a classified listing of subject categories; a chronological listing of NACA publications under each subject category; an alphabetical index to the subject categories; and an author index.

NACA Rept. 1135

Errata No. 1 on "EQUATIONS, TABLES, AND CHARTS FOR COMPRESSIBLE FLOW." Ames Research Staff. 1953.

NACA TN 3109

Errata No. 1 on "AN INVESTIGATION OF LAMELLAR STRUCTURES AND MINOR PHASES IN ELEVEN COBALT-BASE ALLOYS BEFORE AND AFTER HEAT TREATMENT." J. W. Weeton and R. A. Signorelli. March 1954.

NACA TN 3118

Errata No. 2 on "DESIGN DATA FOR MULTIPOST-STIFFENED WINGS IN BENDING." Roger A. Anderson, Aldie E. Johnson, Jr. and Thomas W. Wilder, III. January 1954.

UNPUBLISHED PAPERS

N-18639*

ON THE SUITABILITY OF ELECTROLYTICALLY POLISHED SPECIMENS FOR THE METALLOGRAPHIC INVESTIGATION OF ALUMINUM AND ITS ALLOYS. (Über die Eignung elektrolytische polierter Proben für die metallographische Untersuchung von Aluminum und seinen Legierungen). H. Rohrig and W. Schneider. August 1954. 10p. diagr., photos. (Trans. from Aluminum, v. 23, no. 6, June, 1941, p. 281-284)

Known methods for electrolytic polishing of aluminum parts are reviewed and discussed. It is concluded that the applicability of electrolytic polishing methods to the preparation of metallographic specimens in the field of aluminum is comparatively limited.

DECLASSIFIED NACA REPORTS

THE FOLLOWING REPORTS HAVE BEEN DECLASSIFIED FROM CONFIDENTIAL, 9/10/54

RM A51H20
RM L51111

NACA RM A50H03

PRELIMINARY FLIGHT INVESTIGATION OF THE WING-DROPPING TENDENCY AND LATERAL-CONTROL CHARACTERISTICS OF A 35° SWEPT-WING AIRPLANE AT TRANSONIC MACH NUMBERS. George A. Rathert, Jr., L. Stewart Rolls, Lee Winograd and George E. Cooper. September 11, 1950. 14p. diagrs., photo., tab. (NACA RM A50H03) (Declassified from Confidential, 9/10/54)

Results are presented from a preliminary flight investigation on an F-86A airplane of the lateral-control characteristics and the wing-dropping tendency encountered at high Mach numbers. The wing-dropping tendency was found to result from a combination of three factors: a small initial directional asymmetry, an abrupt increase in positive dihedral effect, and a reduction in the lateral-control effectiveness.

NACA RM A50J09a

PRELIMINARY FLIGHT INVESTIGATION OF THE DYNAMIC LONGITUDINAL-STABILITY CHARACTERISTICS OF A 35° SWEPT-WING AIRPLANE. William C. Triplett and Rudolph D. Van Dyke, Jr. December 11, 1950. 26p. diagrs., photo., tab. (NACA RM A50J09a) (Declassified from Confidential, 9/10/54)

Flight tests were conducted on a 35° swept-wing airplane to determine the dynamic longitudinal-stability characteristics. Period and damping of oscillatory responses were measured over a Mach number range of 0.60 to 1.04. Also presented as functions of Mach number are the static stability parameter C_{m_α}, the factor $C_{m_q} + C_{m_{\dot{\alpha}}}$, and the number of cycles required for the oscillation to damp to 1/10 amplitude. Sharp variations in damping were noted between Mach numbers of 0.88 and 0.96 in addition to a decrease above Mach number 0.96.

NACA RM A51B28

FLIGHT MEASUREMENTS OF THE WING-DROPPING TENDENCY OF A STRAIGHT-WING JET AIRPLANE AT HIGH SUBSONIC MACH NUMBERS. Seth B. Anderson, Edward A. Ernst and Rudolph D. Van Dyke, Jr. April 24, 1951. 16p. diagrs., photo., tab. (NACA RM A51B28) (Declassified from Confidential, 9/10/54)

Flight tests conducted on a straight-wing fighter-type jet airplane showed that the wing-dropping tendency encountered at high subsonic Mach numbers was due primarily to a progressive reduction in aileron effectiveness and an increase in effective dihedral which made the lateral trim particularly sensitive to small changes in sideslip angle.

NACA RM A51C28

A COMPARISON OF THE MEASURED AND PREDICTED LATERAL OSCILLATORY CHARACTERISTICS OF A 35° SWEPT-WING FIGHTER AIRPLANE. Walter E. McNeill and George E. Cooper. July 1951. 21p. diagrs., 3 tabs. (NACA RM A51C28) (Delcassified from Confidential, 9/10/54)

Flight measurements of the lateral oscillatory characteristics of a 35° swept-wing fighter airplane were obtained at altitudes of 10,000 and 35,000 feet for an over-all Mach number range from 0.41 to 1.04. Period, time to damp to half amplitude, and ratio of angle-of-bank amplitude to angle-of-sideslip amplitude, $|\varphi|/|\beta|$, are presented as functions of Mach number for each test altitude, and are compared with values computed from wind-tunnel data and estimated stability derivatives. In general, agreement between the measured and predicted lateral oscillatory characteristics of the test airplane was satisfactory.

NACA RM A51E03

SUBSONIC MACH AND REYNOLDS NUMBER EFFECTS ON THE SURFACE PRESSURES, GAP FLOW, PRESSURE RECOVERY, AND DRAG OF A NONROTATING NACA 1-SERIES E-TYPE COWLING AT AN ANGLE OF ATTACK OF 0°. Robert M. Reynolds and Robert I. Sammonds. July 1951. 73p. diagrs., photo., 3 tabs. (NACA RM A51E03) (Declassified from Confidential, 9/10/54)

Measurements of pressure distributions on the external, inner lip, spinner, and propeller-blade-shank fairing surfaces are presented for an NACA 1-51-117 (E-type) cowling with an NACA 1-41.43-042.86 spinner suitable for a turbine-propeller installation. Ram-recovery ratios, external drag, and gap leak flow are also included. The tests were conducted with the model at an angle of attack of 0° and with the cowling not rotating. The flow characteristics are presented for a range of Mach numbers from 0.23 to 0.88 at a Reynolds number of 1.8 million and for a range of Reynolds numbers from 1.8 to 8.1 million at 0.23 Mach number. Inlet-velocity ratio was varied between 0.06 and 0.78.

NACA RM A51E14

MEASUREMENTS IN FLIGHT OF THE LONGITUDINAL CHARACTERISTICS OF TWO JET AIRCRAFT, ONE WITH A DIVING TENDENCY AND THE OTHER WITH A CLIMBING TENDENCY AT HIGH MACH NUMBERS. Seth B. Anderson. October 1951. 18p. diagrs., photos., 2 tabs. (NACA RM A51E14) (Declassified from Confidential, 9/10/54)

Flight tests conducted on two jet airplanes of generally similar configuration, one identified with a diving tendency and the other with a climbing tendency at high Mach numbers, showed that the difference in longitudinal control appears to be governed by the balance between two opposing moments; a diving tendency caused chiefly by an increase in angle of attack of the horizontal tail surfaces, and a climbing tendency due to the pitching moment of the wing.

NACA RM A51E24

AN EXPERIMENTAL INVESTIGATION AT SUBSONIC SPEEDS OF A SCOOP-TYPE AIR-INDUCTION SYSTEM FOR A SUPERSONIC AIRPLANE. Curt A. Holzhauser. July 1951. 45p. diagrs., photos. (NACA RM A51E24) (Declassified from Confidential, 9/10/54)

Measurements of ram-recovery ratio, static pressure, and boundary layer are presented at a Mach number of 0.17 for a large range of mass-flow ratios, angles of attack, and angles of sideslip for a scoop-type intake located on top of the fuselage. At 0° angles of attack and sideslip the ram-recovery ratio measured at the minimum-area station was 0.98 at a mass-flow ratio of 1.0. Above a mass-flow ratio of 1.2, the ram-recovery ratio decreased rapidly. The variation of ram-recovery ratio with angle of attack was small compared with the variation of ram-recovery ratio with angle of sideslip.

NACA RM A51F12a

INVESTIGATION OF A TRIANGULAR WING IN CONJUNCTION WITH A FUSELAGE AND HORIZONTAL TAIL TO DETERMINE DOWNWASH AND LONGITUDINAL STABILITY CHARACTERISTICS - TRANSONIC BUMP METHOD. Edwin C. Allen. August 1951. 22p. diagrs., photos. (NACA RM A51F12a) (Declassified from Confidential, 9/10/54)

This report presents effective downwash at the tail position and the static longitudinal-stability characteristics of a semispan model having a thin triangular wing of aspect ratio 2, a slender fuselage, and a thin, unswept horizontal tail. The range of Mach numbers was from 0.40 to 1.10 with a corresponding Reynolds number range of 1.0 to 1.9 million. The effects of vertical position of the horizontal tail at one longitudinal station behind the wing were investigated.

NACA RM A51G27

LONGITUDINAL FREQUENCY-RESPONSE CHARACTERISTICS OF A 35° SWEPT-WING AIRPLANE AS DETERMINED FROM FLIGHT MEASUREMENTS, INCLUDING A METHOD FOR THE EVALUATION OF TRANSFER FUNCTIONS. William C. Triplett and G. Allan Smith. September 1951. 45p. diagrs., photo. (NACA RM A51G27) (Declassified from Confidential, 9/10/54)

Data obtained from dynamic flight measurements are used to compute the longitudinal frequency-response characteristics of a 35° swept-wing airplane through the Mach number range of 0.59 to 1.05. Also presented is a general graphical method for the determination of numerical coefficients of the transfer functions from frequency-response data. The variations in these coefficients with changes in Mach number and altitude are shown.

NACA RM A51H09

STABILITY AND CONTROL MEASUREMENTS OBTAINED DURING USAF-NACA COOPERATIVE FLIGHT-TEST PROGRAM ON THE X-4 AIRPLANE (USAF NO. 46-677). Melvin Sadoff, Herman O. Ankenbruck and William O'Hare. October 1951. 38p. diagrs., photos., tab. (NACA RM A51H09) (Declassified from Confidential, 9/10/54)

Results obtained during the Air Force testing of the Northrop X-4 airplane are presented. Information is included on the stalling characteristics, the static and dynamic longitudinal- and lateral-directional stability characteristics and the lateral-control characteristics.

NACA RM A51H20a

COMPARISON OF DRAG, PRESSURE RECOVERY, AND SURFACE PRESSURE OF A SCOOP-TYPE INLET AND AN NACA SUBMERGED INLET AT TRANSONIC SPEEDS. Joseph L. Frank and Robert A. Taylor. December 1951. 63p. diagrs., photos. (NACA RM A51H20a) (Declassified from Confidential, 9/10/54)

Comparative data were obtained for a scoop-type inlet and an NACA submerged inlet at transonic speeds. The submerged inlet effected the higher ram recovery at mass-flow ratios below about 0.50. At maximum mass-flow ratio (0.92) and 0° angle of attack, the ram recovery of the two inlets was about equal. In general, the scoop-type inlet caused the greater external drag.

NACA RM A51J12

A FLIGHT EVALUATION OF THE LONGITUDINAL STABILITY CHARACTERISTICS ASSOCIATED WITH THE PITCH-UP OF A SWEPT-WING AIRPLANE IN MANEUVERING FLIGHT AT TRANSONIC SPEEDS. Seth B. Anderson and Richard S. Bray. November 1951. 33p. diagrs., photo., tab. (NACA RM A51J12) (Declassified from Confidential, 9/10/54)

Flight measurements on a swept-wing jet aircraft showed that the pitch-up encountered in a wind-up turn at transonic Mach numbers was due principally to an unstable break in the wing pitching moment associated with flow separation near the wing tip. The pitch-up encountered in slowing down in a dive-recovery maneuver was due chiefly to a reduction in wing-fuselage stability. An increase in down load for the horizontal tail was indicated with increase in Mach number for normal force-coefficient values in excess of approximately 0.2.

NACA RM A51J11

THE EFFECTS AT TRANSONIC SPEEDS OF THICKENING THE TRAILING EDGE OF A WING WITH A 4-PERCENT-THICK CIRCULAR-ARC AIRFOIL. Joseph W. Cleary and George L. Stevens. December 1951. 43p. diagrs., photo. (NACA RM A51J11) (Declassified from Confidential, 9/10/54)

Effects of systematic variation of trailing-edge thickness of a symmetrical circular-arc airfoil on lift, drag, pitching moment, base pressure, and wake pressure fluctuations were investigated for the transonic Mach number range by the wind-tunnel bump technique. Results show that for trailing-edge thickness of 0.3 of the airfoil thickness beneficial gains in lift-drag ratios can be expected at subsonic Mach numbers with no measurable increase in minimum drag. Higher lift-curve slopes were observed in the transonic Mach number range for blunt-trailing-edge airfoils as compared with circular-arc airfoils.

NACA RM A51J18

THE EFFECTIVENESS OF WING VORTEX GENERATORS IN IMPROVING THE MANEUVERING CHARACTERISTICS OF A SWEPT-WING AIRPLANE AT TRANSONIC SPEEDS. Norman M. McFadden, George A. Rathert, Jr. and Richard S. Bray. February 1952. 45p. photos., diagrs., tab. (NACA RM A51J18) (Declassified from Confidential, 9/10/54)

The effects of wing vortex generators, multiple boundary-layer fences, and extension of the outer two segments of the wing leading-edge slats on the aerodynamic characteristics of a 35° swept-wing fighter were measured in flight tests at transonic speeds and high altitudes. Significant improvements were obtained in the pitch-up and wing-dropping-tendency characteristics with certain arrangements of vortex generators.

NACA RM A51J19a

THE EFFECT OF ENTRANCE MACH NUMBER AND LIP SHAPE ON THE SUBSONIC CHARACTERISTICS OF A SCOOP-TYPE AIR-INDUCTION SYSTEM FOR A SUPERSONIC AIRPLANE. Curt A. Holzhauser. January 1952. 39p. diagrs., photos., tab. (NACA RM A51J19a) (Declassified from Confidential, 9/10/54)

This report presents the ram-recovery ratios and static-pressure distributions of a scoop-type intake with a rounded lip and with a sharp lip. The entrance Mach numbers ranged from 0 to choking for free-stream Mach numbers of 0.08 to 0.33. The wake drag coefficients of these two types of installations are compared. The ram-recovery ratio of the intake with a rounded lip was greater than with a sharp lip at the higher mass-flow ratios. When the air flow was separated in the duct, the ram-recovery ratio decreased with increasing entrance Mach numbers.

NACA RM E50H16a

INVESTIGATION OF IGNITION CHARACTERISTICS OF AN-F-32 AND TWO AN-F-58a FUELS IN SINGLE CAN-TYPE TURBOJET COMBUSTOR. Warren D. Rayle and Howard W. Douglass. October 13, 1950. 25p. photos., diagrs., 2 tabs. (NACA RM E50H16a) (Declassified from Confidential, 9/10/54)

Ignition characteristics of AN-F-32 and two AN-F-58a fuels were studied in a single can-type turbojet combustor under air-flow conditions representing engine speeds of 1600, 2500, and 4000 rpm, altitudes from sea level to 30,000 feet, ambient temperatures at sea level from 90° to -36° F, and flight Mach numbers of 0 and 0.6. Critical fuel-flow rates for ignition increased with increase in preignition engine speed, with increase in altitude, or with decrease in sea-level ambient temperature. This flow rate appears to increase in a direct relation to decrease in fuel volatility as indicated by the 10-percent-evaporated temperature.

NACA RM E51B02

COMBUSTION PROPERTIES OF ALUMINUM AS RAM-JET FUEL. J. Robert Branstetter, Albert M. Lord and Melvin Gerstein. March 28, 1951. 37p. diagrs., photos. (NACA RM E51B02) (Declassified from Confidential 9/10/54)

An experimental investigation was conducted on the combustion properties of aluminum as a fuel for use in jet-powered aircraft. Two techniques of injection were investigated. In one method aluminum powder was utilized whereas in the other aluminum wire was utilized. Aluminum powder was burned stably and at combustion efficiencies that averaged about 50 percent, although the thrust obtained was less than that obtained by burning propane at equivalent conditions. Aluminum wire was burned with about 75 percent combustion efficiency. Solid deposits in the combustors were found to be a serious obstacle to the use of aluminum as a ram-jet fuel.

NACA RM E51B08

CORRELATION OF ANALOG SOLUTIONS WITH EXPERIMENTAL SEA-LEVEL TRANSIENT DATA FOR CONTROLLED TURBINE-PROPELLER ENGINE, INCLUDING ANALOG RESULTS AT ALTITUDES. James Lazar and Wilfred L. DeRocher, Jr. August 1951. 36p. diagrs. (NACA RM E51B08) (Declassified from Confidential, 9/10/54)

A satisfactory correlation was obtained between experimental sea-level transient data and solutions from the analog representation. The analog representation is accomplished by transfer functions that were formed from a frequency-response analysis of the experimental transient data as obtained from the controlled engine. This analog representation was then used to compute system response at altitude.

NACA RM E51C02

CARBON DEPOSITION OF SEVERAL SPECIAL TURBOJET-ENGINE FUELS. Jerrold D. Wear and James W. Useller. April 10, 1951. 15p. photos., diagr., tab. (NACA RM E51C02) (Declassified from Confidential, 9/10/54)

Investigations were conducted to determine the carbon forming characteristics of MIL-F-5624 and MIL-F-5161 type fuels in a single J33 combustor and of a MIL-F-5161 fuel in a J35 full-scale engine. The carbon deposition of the fuels investigated in the single combustor could be estimated from a previously established empirical correlation with volumetric average boiling temperature and hydrogen-carbon ratio. The results indicated that MIL-F-5161 type fuels formed more carbon in the single combustor and the full-scale turbojet engine than most MIL-F-5624 type fuels, and may result in marginal operation in several turbojet engines.

NACA RM E51C14

EFFECT OF FUEL VOLATILITY ON PERFORMANCE OF TAIL-PIPE BURNER. Zelmar Barson and Arthur F. Sargent, Jr. April 30, 1951. 18p. diagrs., tab. (NACA RM E51C14) (Declassified from Confidential, 9/10/54)

Fuels having Reid vapor pressures of 6.3 and 1.0 pounds per square inch were investigated in a tail-pipe burner on an axial-flow-type turbojet engine at a simulated flight Mach number of 0.6 and altitudes from 20,000 to 45,000 feet. With the burner configuration used in this investigation, having a mixing length of only 8 inches between the fuel manifold and the flame holder, the low-vapor-pressure fuel gave lower combustion efficiency at a given tail-pipe fuel-air ratio. Because the exhaust-nozzle area was fixed, the lower efficiency resulted in lower thrust and higher specific fuel consumption. The maximum altitude at which the burner would operate was practically unaffected by the change in fuel volatility.

NACA RM E51D16

INVESTIGATION OF MECHANISMS OF BLADE FAILURE OF FORGED HASTELLOY B AND CAST STELLITE 21 TURBINE BLADES IN TURBOJET ENGINE. C. Yaker, C. F. Robards and F. B. Garrett. August 1951. 41p. diagrs., photos., 2 tabs. (NACA RM E51D16) (Declassified from Confidential, 9/10/54)

An investigation was conducted to study the mechanisms of blade failure of forced Hastelloy B and cast Stellite 21. The blades were mounted in a 16-25-6 alloy rotor and subjected to 20-minute cycles consisting of 15 minutes at rated speed and approximately 5 minutes at idle. The first failures of the Hastelloy B and Stellite 21 blades were probably the result of excessive vibratory stresses and occurred after 14.25 and 16.75 hours, respectively. After 28.75 hours of operation, all but 3 of the original 25 Hastelloy B blades had either failed or contained stress-rupture-type cracks and four of the original 27 Stellite 21 blades contained stress-rupture-type cracks.

NACA RM E51D26

ANALYSIS OF EXPERIMENTAL SEA-LEVEL TRANSIENT DATA AND ANALOG METHOD OF OBTAINING ALTITUDE RESPONSE FOR TURBINE-PROPELLER ENGINE WITH RELAY-TYPE SPEED CONTROL. George Vasu and George J. Pack. May 17, 1951. 28p. diagrs., photo. (NACA RM E51D26) (Declassified from Confidential, 9/10/54)

Correlation has been established between transient engine and control data obtained experimentally and data obtained by simulating the engine and control with an analog computer. This correlation was established at sea-level conditions for a turbine-propeller engine with a relay-type speed control. The behavior of the controlled engine at altitudes of 20,000 and 35,000 feet was determined with an analog computer using the altitude pressure and temperature generalization factors to calculate the new engine constants for these altitudes. Because the engine response varies considerably at altitude some type of compensation appears desirable and four methods of compensation are discussed.

NACA RM E51F11

ALTITUDE-IGNITION LIMIT OF A TURBOJET ENGINE USING A CONDENSER-DISCHARGE IGNITION SYSTEM. John C. Armstrong. October 1951. 5p. diagrs. (NACA RM E51F11) (Declassified from Confidential, 9/10/54)

The altitude-ignition limits of a condenser-discharge ignition system installed on a turbojet engine were determined at a flight Mach number of 0.6 using 1.1-pound Reid vapor pressure fuel. Ignition was possible up to an altitude of 55,000 feet with 4.8 joules per spark and 6 sparks per second.

NACA RM E51F18

VELOCITY AND TEMPERATURE FIELDS IN CIRCULAR JET EXPANDING FROM CHOKED NOZZLE INTO QUIESCENT AIR. Morris D. Rousso and Fred D. Kochendorfer. July 1951. 34p. diagrs., photos. (NACA RM E51F18. Formerly RM E50E03a) (Declassified from Confidential, 9/10/54)

The Mach number and temperature profiles in jets expanding from convergent and convergent-divergent nozzles are presented for several values of nozzle-exit pressure ratio. The effects of jet temperature, Reynolds number, and humidity on jet spreading are briefly evaluated. The results indicated that the downstream Mach number profiles for a heated jet are slightly narrower than those for an unheated jet, whereas the downstream temperature profiles were unaffected by nozzle temperature change, and that the effects of Reynolds number and humidity were negligible.

NACA RM L51E01

CONTRIBUTIONS OF WING, TAIL, AND FUSELAGE TO THE AERODYNAMIC CHARACTERISTICS OF A SEMISPAN MODEL OF A SUPERSONIC AIRPLANE CONFIGURATION AT TRANSONIC SPEEDS FROM TESTS BY THE NACA WING-FLOW METHOD. Norman S. Silsby and James M. McKay. July 1951. 34p. diagrs., photos., tab. (NACA RM L51E01) (Declassified from Confidential, 9/10/54)

An investigation has been made by the NACA wing-flow method at transonic speeds to determine the contributions of wing, tail, and fuselage to the aerodynamic characteristics of a semispan airplane model having a long slender fuselage and a straight wing and tail of low aspect ratio with faired symmetrical double-wedge airfoil sections 4.6-percent chord in thickness. Lift, drag, and pitching moments were obtained for the complete model, wing-fuselage configuration, fuselage-tail configuration, and fuselage alone. The Mach number range of the tests was from 0.60 to 1.13, and the Reynolds number range was from about 0.3×10^6 to 0.7×10^6.

NACA RM L51E07

SYSTEM ANALYSES AND AUTOPILOT DESIGN FOR AUTOMATIC ROLL STABILIZATION OF A SUPERSONIC PILOTLESS AIRCRAFT. Jacob Zarovsky. July 1951. 55p. diagrs., tab. (NACA RM L51E07) (Declassified from Confidential, 9/10/54)

Automatic roll stabilization system analysis and roll autopilot detail design have been conducted for a supersonic pilotless aircraft with twin jet engines. The autopilots investigated were a gyro-actuated control, a gyro-actuated control with a rate-sensing device (to provide additional damping), and an electronic hydraulic autopilot. It was concluded that an electronic-hydraulic roll autopilot with a passive electrical network and suitable gain adjustment appears to be a practical and realizable means of providing the required system roll stabilization characteristics.

NACA RM L51E09

WING-FLOW STUDY OF PRESSURE-DRAG REDUCTION AT TRANSONIC SPEED BY PROJECTING A JET OF AIR FROM THE NOSE OF A PROLATE SPHEROID OF FINENESS RATIO 6. Mitchell Lopatoff. October 1951. 20p. photos., diagrs., tab. (NACA RM L51E09) (Declassified from Confidential, 9/10/54)

Contains studies by NACA wing-flow method of pressure-drag reduction obtained at transonic speed by projecting a jet of air from the nose of a prolate spheroid. Comparisons of pressure distributions with and without the jet are made. Shadowgraphs of the model obtained in a small supersonic tunnel at a constant Mach number of 1.5 while the thrust of the jet was varied are presented.

NACA RM L51E18

RESULTS OF FLIGHT TESTS TO DETERMINE DRAG OF PARABOLIC AND CONE-CYLINDER BODIES OF VERY LARGE FINENESS RATIOS AT SUPERSONIC SPEEDS. Clement J. Welsh and Carlos A. deMoraes. August 1951. 17p. diagrs., photos. (NACA RM L51E18) (Declassified from Confidential, 9/10/54)

Results of free-flight investigation at supersonic speeds to determine zero-lift drag of bodies of revolution with varying fineness ratios are presented for both parabolic and cone-cylinder bodies.

NACA RM L51E25a

A PRELIMINARY INVESTIGATION OF COMBUSTION WITH ROTATING FLOW IN AN ANNULAR COMBUSTION CHAMBER. Ira R. Schwartz. September 1951. 18p. diagrs., photos. (NACA RM L51E25a) (Declassified from Confidential, 9/10/54)

A preliminary investigation of flame-stability and flame-extinction characteristics of a propane-air mixture in an annular combustion chamber was conducted with both straight and rotational flow. The rotating mixture burned at higher axial-inlet stream velocities and with more stable flames than could be obtained with straight-flow burning. Unsteady burning, accompanied by the pulsations and intense noise usually present in straight-flow burning, was not present in the rotating-flow burning. The external axial-flame length was appreciably less and the flame divergence was greater with rotating flow.

NACA RM L51F01

COMPARISON OF AIRFOIL SECTIONS ON TWO TRIANGULAR-WING-FUSELAGE CONFIGURATIONS AT TRANSONIC SPEEDS FROM TESTS BY THE NACA WING-FLOW METHOD. Albert W. Hall and James M. McKay. August 1951. 23p. diagrs., photo., tab. (NACA RM L51F01) (Declassified from Confidential, 9/10/54)

Tests were made by the NACA wing-flow method at transonic speeds on four triangular-wing-fuselage models. Two models had wings of aspect ratio 2.31 with NACA 65009 and 9-percent-thick biconvex sections and two models had wings of aspect ratio 4.00 with NACA 65006 and 6-percent-thick double-wedge sections. Lift, drag, pitching-moment, and angle-of-attack measurements are presented for a Mach number range of 0.75 to 1.075. The test Reynolds number was approximately 1.5×10^6.

NACA RM L51F01a

STATIC LATERAL STABILITY CHARACTERISTICS OF A 1/10-SCALE MODEL OF THE X-1 AIRPLANE AT HIGH SUBSONIC MACH NUMBERS. Richard E. Kuhn and James W. Wiggins. August 1951. 25p. diagrs., photos. (NACA RM L51F01a) (Declassified from Confidential, 9/10/54)

Results are presented of an investigation made in the Langley high-speed 7- by 10-foot tunnel to determine the high-speed static lateral and directional characteristics of a 1/10-scale model of the X-1 transonic research airplane from a Mach number of 0.40 to 0.88.

NACA RM L51F06a

AERODYNAMIC CHARACTERISTICS AT TRANSONIC SPEEDS OF A TAPERED 45° SWEPTBACK WING OF ASPECT RATIO 3 HAVING A FULL-SPAN FLAP-TYPE CONTROL. TRANSONIC-BUMP METHOD. Vernard E. Lockwood and Joseph E. Fikes. August 1951. 35p. diagrs. (NACA RM L51F06a) (Declassified from Confidential, 9/10/54)

Lift, drag, pitching-moment, rolling moment, and flap hinge-moment coefficients were obtained by the transonic-bump method on a wing having a quarter chord sweepback of 45.58°, aspect ratio of 3, a taper ratio of 0.5 and an NACA 64A010 section employing a 0.254-chord full-span flap. The investigation was made at angles of attack of 0°, 4°, and 8°, flap deflections from -27° to 5°, and Mach numbers from 0.6 to 1.17. The investigation was made with the gap at the nose of the flap both sealed and unsealed. The results from the bumps, an investigation of a large model at higher Reynolds number, and available estimation methods are compared.

NACA RM L51F08

A METHOD FOR THE DESIGN OF SWEPTBACK WINGS WARPED TO PRODUCE SPECIFIED FLIGHT CHARACTERISTICS AT SUPERSONIC SPEEDS. Warren A. Tucker. September 1951. 52p. diagrs., 2 tabs. (NACA RM L51F08) (Declassified from Confidential, 9/10/54)

A method is presented for designing sweptback wings to be self-trimming at a given set of flight conditions. This characteristic is achieved by warping the wing in a particular manner, that is, by giving the wing a certain combination of angle of attack, twist, and camber. The method applied directly to a wide class of sweptback wings. The application to any specific wing is simplified to a routine computational procedure, and a discussion is given of some points to be considered in the application to a practical case. Several illustrative examples are worked out, and the resulting wings are shown to be feasiable to construct.

NACA RM L51F08a

SMALL-SCALE INVESTIGATION AT TRANSONIC SPEEDS OF THE EFFECTS OF THICKENING THE INBOARD SECTION OF A 45° SWEPTBACK WING OF ASPECT RATIO 4, TAPER RATIO 0.3, AND NACA 65A006 AIRFOIL SECTION. Kenneth P. Spreemann and William J. Alford, Jr. August 1951. 21p. diagrs., photo. (NACA RM L51F08a) (Declassified from Confidential, 9/10/54)

An investigation was conducted in the Langley high-speed 7- by 10-foot tunnel over a Mach number range of 0.60 to 1.08 to determine the aerodynamic effects of thickening the inboard 40 percent of a semispan wing with the quarter-chord line swept back 45°, an aspect ratio of 4, a taper ratio of 0.3, and an NACA 64A006 airfoil section. Lift, drag, pitching moment, and bending moment were obtained for the two wings. Also included in the paper are some comparisons of experimental results with theory, corrected to elastic conditions.

NACA RM L51F12

TABULATED PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS MEASURED IN FLIGHT ON THE WING OF THE D-558-I RESEARCH AIRPLANE THROUGH A MACH NUMBER RANGE OF 0.80 TO 0.89 AND THROUGHOUT THE NORMAL-FORCE-COEFFICIENT RANGE AT MACH NUMBERS OF 0.61, 0.70, 0.855, AND 0.88. Earl R. Keener and Rozalia M. Bandish. August 1951. 43p. diagrs., photos., 7 tabs. (NACA RM L51F12) (Declassified from Confidential, 9/10/54)

Presents tabulated pressure coefficients and aerodynamic characteristics obtained in flight from pressure distributions over six chordwise rows of orifices on a wing of the Douglas D-558-I research airplane (BuAero No. 37972). It includes data obtained throughout a Mach number range of 0.80 to 0.89 and throughout the normal-force-coefficient range at M = 0.61, 0.70, 0.855, and 0.88.

NACA RM L51F19

THEORETICAL ANALYSES TO DETERMINE UNBALANCED TRAILING-EDGE CONTROLS HAVING MINIMUM HINGE MOMENTS DUE TO DEFLECTION AT SUPERSONIC SPEEDS. Kennith L. Goin. November 1952. 52p. diagrs., tab. (NACA RM L51F19) (Declassified from Confidential, 9/10/54)

Theoretical analyses have been made to determine the plan forms of unbalanced trailing-edge flap-type controls having minimum hinge moments due to deflection and requiring minimum work to overcome the hinge moments due to deflection at supersonic speeds. Ratios of lift and rolling moment to hinge moment and lift and rolling moment to deflection work at fixed values of lift and rolling effectiveness were used as bases for the analyses. The effects of control plan form, control location, and Mach number have been considered.

NACA RM L51F26

EFFECTS OF PROPELLER-SHANK GEOMETRY AND PROPELLER-SPINNER-JUNCTURE CONFIGURATION ON CHARACTERISTICS OF AN NACA 1-SERIES COWLING-SPINNER COMBINATION WITH AN EIGHT-BLADE DUAL-ROTATION PROPELLER. Arvid L. Keith, Jr., Gene J. Bingham and Arnold J. Rubin. September 1951. 73p. diagrs., photos., 5 tabs. (NACA RM L51F26) (Declassified from Confidential, 9/10/54)

Results of low-speed investigation of aerodynamic characteristic of NACA 1-series cowling-spinner combination equipped with several eight-blade dual-rotation propellers differing in shank-thickness ratio are presented. Studies of sealed and faired propeller spinner junctures, four junctures that permit blade rotation, and two methods for retarding spinner boundary-layer separation are included.

NACA RM L51F28

EFFECTS OF SPANWISE THICKNESS VARIATION ON THE TRANSONIC AERODYNAMIC CHARACTERISTICS OF WINGS HAVING 35° OF SWEEPBACK, ASPECT RATIO 4, AND TAPER RATIO 0.60. William D. Morrison, Jr. and Paul G. Fournier. September 1951. 21p. diagrs., photo. (NACA RM L51F28) (Declassified from Confidential, 9/10/54)

The aerodynamic characteristics of a wing tapered in thickness from 6 percent at the root to 2 percent at the tip having 35° sweepback, aspect ratio 4, and taper ratio 0.60 have been determined by a reflection plane technique over a Mach number range from 0.60 to 1.08 at a Reynolds number of about 650,000. The results of this investigation are compared with those of a wing of identical plan form but of a constant thickness ratio. Theoretical subsonic and low-supersonic calculation of lift-curve slope, aerodynamic center, and lateral center-of-lift location are compared with experimental results.

NACA RM L51F29

BASE PRESSURES MEASURED ON SEVERAL PARABOLIC-ARC BODIES OF REVOLUTION IN FREE FLIGHT AT MACH NUMBERS FROM 0.8 TO 1.4 AND AT LARGE REYNOLDS NUMBERS. Ellis Katz and William E. Stoney, Jr. October 1951. 20p. diagrs., photos. (NACA RM L51F29) (Declassified from Confidential, 9/10/54)

Base pressures were measured on several fin stabilized bodies of parabolic-arc profile in free flight at Mach numbers from 0.8 to 1.4 and at Reynolds numbers from 20 to 130 million. The bodies varied in length from 6 to 25 diameters and had afterbodies which converged to base areas equal to 19.1 percent of the frontal areas. Pressures were also measured on the side of the bodies immediately ahead of the bases.

NACA RM L51G03

AN INVESTIGATION AT TRANSONIC SPEEDS OF THE EFFECTS OF CONTROL CHORD AND SPAN ON THE CONTROL CHARACTERISTICS OF A TAPERED WEDGE-TYPE WING OF ASPECT RATIO 2.5. TRANSONIC-BUMP METHOD. Raymond D. Vogler, Vernard E. Lockwood and Thomas R. Turner. September 1951. 36p. diagrs. (NACA RM L51G03) (Declassified from Confidential, 9/10/54)

This paper presents the results of a control investigation of 25-, 35-, and 45-percent-chord controls of various spanwise magnitudes on an unswept double-wedge-type wing of aspect ratio 2.5 and taper ratio of 0.625. Rolling and pitching moments and lift of the semispan wing-fuselage combination were obtained through a Mach range of 0.6 to 1.18 and at a Reynolds number near 1.2×10^6. The control deflections ranged from 0° to 15°. The investigation was conducted in the Langley high-speed 7- by 10-foot tunnel using the transonic bump.

NACA RM L51G09

PRELIMINARY INVESTIGATION OF THE EFFECTS OF RECTANGULAR VORTEX GENERATORS ON THE PERFORMANCE OF A SHORT 1.9:1 STRAIGHT-WALL ANNULAR DIFFUSER. Charles C. Wood. October 1951. 27p. diagrs., photo., tab. (NACA RM L51G09) (Declassified from Confidential, 9/10/54)

Results are presented of a preliminary investigation of vortex generators introduced into the region of boundary layer near the inlet of a short annular diffuser to increase turbulent mixing in an attempt to prevent separation and resulting adverse effects. Rectangular noncambered airfoils were used as vortex generators and were varied in chord, span, angle of attack, number, and location. Some of the vortex generator arrangements resulted only in small increases to diffuser performance, while other arrangements resulted in substantial increases. The effect of one of the better vortex-generator arrangements was to eliminate separation of the flow entirely and to increase the diffuser effectiveness 17 percent.

NACA RM L51G20

A CORRELATION OF EXPERIMENTAL ZERO-LIFT DRAG OF RECTANGULAR WINGS WITH SYMMETRICAL NACA 65-SERIES AIRFOIL SECTIONS BY MEANS OF THE TRANSONIC SIMILARITY LAW FOR WINGS OF FINITE ASPECT RATIO. Edward C. B. Danforth. September 1951. 20p. diagrs. (NACA RM L51G20) (Declassified from Confidential, 9/10/54)

This paper contains a correlation of zero-lift transonic pressure drag of rectangular wings of finite aspect ratio by means of a transonic similarity law derived in NACA TN 2273. The data correlated were for wings of exposed aspect ratio between 1.12 and 6.25 and thickness ratios between 0.03 and 0.12, all with symmetrical NACA 65-series airfoil sections.

NACA RM L51H02

A THEORETICAL INVESTIGATION OF THE INFLUENCE OF AUTOPILOT NATURAL FREQUENCY UPON THE DYNAMIC PERFORMANCE CHARACTERISTICS OF A SUPERSONIC CANARD MISSILE CONFIGURATION WITH A PITCH-ATTITUDE CONTROL SYSTEM. Anthony L. Passera. October 1951. 32p. diagrs., photos., 2 tabs. (NACA RM L51H02) (Declassified from Confidential, 9/10/54)

A theoretical investigation is made to determine the effects of the natural frequency of a single-degree-of-freedom autopilot upon the dynamic performance characteristics of a supersonic canard missile configuration with rate-damping and pitch-attitude control system. These effects are presented in the form of pitch-angle, control-surface deflection, and normal acceleration transients for several flight conditions in response to a unit step attitude command signal.

NACA RM L51H16a

LOW-SPEED WIND-TUNNEL INVESTIGATION OF A FIXED AND A FREE-FLOATING WING-TIP AILERON ON A WING WITH LEADING EDGE SWEPT BACK 51.3°. R. G. MacLeod. February 1952. 17p. diagrs., photo., tab. (NACA RM L51H16a) (Declassified from Confidential, 9/10/54)

Contains results of a low-speed wind-tunnel investigation of a fixed and a free-floating wing-tip aileron on a wing with leading edge swept back 51.3°. Results indicate that the rolling effectiveness of both ailerons was maintained up to very large angles of attack while the yaw due to aileron deflection was more favorable for the free-floating aileron.

NACA RM L51H22

AERODYNAMIC CHARACTERISTICS AT TRANSONIC SPEEDS OF A 60° DELTA WING EQUIPPED WITH A CONSTANT-CHORD FLAP-TYPE CONTROL WITH AND WITHOUT AN UNSHIELDED HORN BALANCE. TRANSONIC-BUMP METHOD. Harleth G. Wiley and Leon Zontek. September 1952. 25p. diagrs. (NACA RM L51H22) (Declassified from Confidential, 9/10/54)

This paper presents the aerodynamic characteristics of a 60° delta wing of aspect ratio 2.31, taper ratio 0, and an NACA 65-006 airfoil section, which was equipped with a constant-chord control, with and without an unshielded triangular horn balance. Lift, pitching moment, and hinge moment were obtained at various angles of control deflection and angles of attack for both types of controls through a Mach number range of 0.6 to 1.18.

NACA RM L51H23

THE EFFECTS ON THE AERODYNAMIC CHARACTERISTICS OF REVERSING THE WING OF A TRIANGULAR WING-BODY COMBINATION AT TRANSONIC SPEEDS AS DETERMINED BY THE NACA WING-FLOW METHOD. James M. McKay and Albert W. Hall. October 1951. 22p. diagrs., photo., 2 tabs. (NACA RM L51H23) (Declassified from Confidential, 9/10/54)

Tests were made by the NACA wing-flow method on two triangular wing-fuselage models of low aspect ratio with 6-percent-thick biconvex sections. On one model the apex angle of the wing was forward and on the other the apex angle was trailing. Lift, drag, pitching moment, and angle-of-attack measurements are presented for a Mach number range of 0.75 to 1.075. The test Reynolds number was approximately 1.5×10^6.

NACA RM L51H27

INVESTIGATION OF WING-TIP AILERONS ON A 51.3° SWEPTBACK WING AT TRANSONIC SPEEDS BY THE TRANSONIC-BUMP METHOD. William C. Moseley, Jr. and James M. Watson. November 1951. 60p. diagrs. (NACA RM L51H27) (Declassified from Confidential, 9/10/54)

Three wing-tip ailerons were tested through the transonic range on a 51.3° sweptback wing. One was a triangular wing tip deflectable about an axis normal to the leading edge of the wing; the second was a triangular tip added to the basic wing; and the third, utilizing the extended tip area, was obtained by deflecting the area aft of a spanwise axis through the 0.50-tip-chord station of the basic wing. The last two ailerons provided lateral control over the Mach number range at low angles of attack.

NACA RM L51H28

AERODYNAMIC CHARACTERISTICS AT TRANSONIC SPEEDS OF A WING HAVING 45° SWEEP, ASPECT RATIO 8, TAPER RATIO 0.45, AND AIRFOIL SECTIONS VARYING FROM THE NACA 63A010 SECTION AT THE ROOT TO THE NACA 63A006 SECTION AT THE TIP. William D. Morrison, Jr. and Paul G. Fournier. January 1952. 22p. diagrs., photo. (NACA RM L51H28) (Declassified from Confidential, 9/10/54)

The aerodynamic characteristics of a wing tapered in thickness ratio from 10 percent at the root chord to 6 percent at the tip chord, having 45° sweepback, aspect ratio 8, and taper ratio 0.45 have been determined by a reflection-plane technique over a Mach number range from 0.60 to 1.05 at a Reynolds number of about 500,000. The results of this investigation are compared with those obtained for a wing of identical plan form but of a constant 12-percent section thickness. Theoretical subsonic calculations of lift-curve slope, and aerodynamic-center and lateral-center-of-lift locations are compared with the experimental results.

NACA RM L51H29

THE EFFECT OF RAKING THE AILERON TIPS ON THE LATERAL-CONTROL AND HINGE-MOMENT CHARACTERISTICS OF A 20-PERCENT-CHORD PARTIAL-SPAN OUTBOARD AILERON ON A WING WITH LEADING EDGE SWEPT BACK 51.3°. Alexander D. Hammond. November 1951. 41p. diagrs., photo., tab. (NACA RM L51H29) (Declassified from Confidential, 9/10/54)

A wind-tunnel investigation at low speed was made to determine the lateral-control and hinge-moment characteristics of an unsealed plain-radius-nose 20-percent-chord flat-sided partial-span outboard aileron having various plan forms on a wing with the leading edge swept back 51.3°, aspect ratio 3.06, taper ratio 0.49, and NACA 65_1-012 airfoil sections perpendicular to the 55.6-percent-chord line. The results of the investigation indicate that, for ailerons having the same area, plan form has little or no effect on the variation of rolling-moment coefficient with aileron deflection. Changes in the aileron plan form, however, have an appreciable effect on the hinge-moment parameter C_{h_δ}.

NACA RM L51H30

SUMMARY OF RESULTS OBTAINED BY TRANSONIC-BUMP METHOD ON EFFECTS OF PLAN FORM AND THICKNESS OF LIFT AND DRAG CHARACTERISTICS OF WINGS AT TRANSONIC SPEEDS. Edward C. Polhamus. November 1951. 33p. diagrs., tab. (NACA RM L51H30) (Declassified from Confidential, 9/10/54)

This paper presents a summary of the effects of plan form and thickness on the lift and drag characteristics of wings at transonic speeds and comparisons with subsonic, transonic, and supersonic theories. The data considered in this summary were obtained during a transonic research program conducted in the Langley high-speed 7- by 10-foot tunnel by the transonic bump method. The Reynolds numbers of the tests were generally less than 1×10^6.

NACA RM L51I06

EFFECTS OF HORIZONTAL-TAIL POSITION, AREA, AND ASPECT RATIO ON LOW-SPEED STATIC LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A 60° TRIANGULAR-WING MODEL HAVING VARIOUS TRIANGULAR-ALL-MOVABLE HORIZONTAL TAILS. Byron M. Jaquet. December 1951. 61p. diagrs., photo., tab. (NACA RM L51I06) (Declassified from Confidential, 9/10/54)

A low-speed investigation (Mach number of 0.17 and Reynolds number of 2.06×10^6) was made in the Langley stability tunnel to determine the static longitudinal stability and control characteristics of a 60° triangular-wing model having various all-movable triangular horizontal tails. Effects of tail length, height, area, and aspect ratio are presented. All-movable tails are compared with constant-chord flaps and half-delta tip controls.

NACA RM L51I21

SMALL-SCALE INVESTIGATION OF THE EFFECTS OF TWIST AND CAMBER ON THE AERODYNAMIC CHARACTERISTICS OF A 60° 42' SWEPTBACK WING OF ASPECT RATIO 1.94. Kenneth P. Spreemann and William J. Alford, Jr. January 1952. 19p. diagrs., photo., tab. (NACA RM L51I21) (Declassified from Confidential, 9/10/54)

An investigation of two semispan wings having the same plan form was conducted in the Langley high-speed 7- by 10-foot tunnel over a Mach number range of 0.59 to 1.10 to determine the effects of twist and camber on the aerodynamic characteristics of a sweptback wing rotated from its original design position. This paper presents the results of the investigation of the two semispan wings swept back 60° 42'; one wing was untwisted and uncambered, the other incorporated twist and camber. The wings had aspect ratios of 1.94, taper ratios of 0.44, and NACA 64A-series airfoil sections tapered in thickness. Lift, drag, pitching moment, and bending moment were obtained for the two wings.

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